Influence particle size of emulsions on quality and stability of beverages

Oksana Lugovska, Vasiliy Sydor

National University of Food Technology, Kyiv, Ukraine

Keywords:

Emulsion
Stability
Homogenizer
Stability

Article history:

Received 25.10.2013
Received in revised form 24.11.2013
Accepted 23.12.2013

Corresponding author:

Oksana Lugovska
E-mail:
Oksana.Lugovska@
rambler.ru

ABSTRACT

Introduction. It is necessary to determine the effect of particle size on the stability of emulsions during storage and use in drinks.

Materials and methods. Investigated samples of emulsions with different stabilizers (gum arabic, modified starch), the size of 0,1-1,0 microns and about 1.0 microns. In determining the stability of the emulsion particle diameter determined by laser granulometry and placement on the stability of soft drink for 180 days, which was used emulsion.

Results and discussion. Technologies emulsion preparation of gum arabic and starch differ. For emulsions of slices to 1 micron important to choose a certain pressure homogenizer for water and oil phases. During storage products with particle size of 1.0 microns appear more «creaming», which is associated with disruption of the structure and transformation of oil emulsion particles into larger and their ascent to the surface. In products with particle sizes 0,1-1,0 micron emulsions such changes were observed. In the manufacture of emulsion products, in order to maintain their stability and quality, particle size emulsion should not exceed 1.0 mm. The research results can be used in the production of emulsions for beverages.

Introduction

Some foods, especially beverages that are made using emulsions containing 1-1000 nm particle size and treated as objects of classical colloid chemistry.

Of great importance for the stability of these products is the size of the particles. In the case where known information about the particle size emulsion, then you can control their stability and quality. It is known that the diameter of the emulsion depends on a process of manufacturing technology, the recipe emulsion. To prepare emulsions, ie dispersion of one liquid in another, in practice, using mechanical means, which allow disperse phase.

There is a theory about the mechanism of emulsification [1]. The first stage of this process lies in the tension drops of liquid dispersion in a field environment. Pulling drops in thread accompanied by an increase of the surface and flow of work to overcome the molecular forces of surface tension. This extended liquid drop becomes so unstable that

spontaneously breaks into small spherical droplets. This is the second stage of the formation of emulsions, which is accompanied by a decrease in surface and spontaneous process. Then comes the next, third stage, when formed droplets on the one hand, coagulated in collisions, and the other - again stretching into smaller parts to equilibrium. The basis of increasing dispersion emulsion is spontaneous decay drops learned to unstable size [2, 3, 4].

Found that a stable, emulsions are closely associated with the mechanism of dispersion and depends on many factors, such as oil content, type and concentration of emulsifier, the route of administration phases, time and intensity and degree of dispersion and temperature. Study of factors that ensure stability of emulsion, led to the conclusion that the critical degree of dispersion [5-9].

Experiments found that for each type of emulsifier has its own optimum concentration that provides the highest resistance obtained emulsions [7]. For an introduction to emulsify oils (for each concentration of emulsifier) is also optimum in which the most stable emulsion is obtained, that are determining the optimal ratio between the aqueous and oil phases. Introduction of excess oil causing stratification. Thus for each emulsifier is its optimum concentration, the corresponding amount of oil in the emulsion [8].

The optimum concentrations of emulsifiers for certain ratios of the phases in obtaining stable emulsions are not fixed and depend on the degree of dispersion. The use of high-speed mixing [9], and especially increasing pressure homogenizer leads to increased dispersion, viscosity and the formation of more stable emulsions [10].

Materials and methods

The aim of the study particle size effects on the stability of emulsions during storage and use in the manufacture of beverages and their stability during 180 days. As materials for research received samples of emulsions prepared with various stabilizers (gum arabic, modified starch) under two versions of recipes. Two variants of emulsions prepared with particle size:

- From 0.1 microns to 1.0 microns
- More than 1.0 microns.

Emulsions received under recipe, below.

Emulsion for drinks. Recipe for 100 liters of finished product

	unit	variations recipes	
Name of raw materials		**1**	**2**
Arabic gum	kg	-	14
Modified starch	kg	15	-
Vegetable oil *	kg	6,4	1,5
Rezynogum	kg	4,7	1,4
Flavor **	kg	1	3
Citric acid	kg	0,2	0,2
Sodium benzoate	kg	0,17	0,17

* - For emulsion - type orange, tangerine, grapefruit, tropic used orange, grapefruit, tangerine oil, for lemon - lemon oil, for After that, mango, peach and apricot -peach butter.
** - For each emulsion using the correct flavor.

To provide color used synthetic and natural dyes and mixtures of dyes in certain quantities. Recommended dosage emulsion: 1,5 kg/1000 liter drink.

Investigation of the stability of emulsions was carried out by determining the size of the diameter of the particles by laser granulometry and placement on the stability of soft drink, which was used emulsion for 180 days. In the production of emulsions initially prepared aqueous and lipid phases, mixed them turbo-mixer and received pre-emulsion with particle size of about 3.0 microns. In the next step, by homogenizing the emulsion obtained with particle size from 0.1 to 1.0 microns. During the preparation of the aqueous phase in water soluble all items that are part of this phase: stabilizers (gum arabic, modified starch), acid dyes, water soluble, preservatives, antioxidants (ascorbic acid). In practice, the most important stabilizer in the manufacture of emulsions for soft drinks are: gum arabic and modified starch. To protect the product from microbial spoilage used preservative sodium benzoate. Acidification lemon emulsion or malic acid to pH 4,0 bolsters preservative as well as a positive effect on the effective viscosity of the emulsion.

An important factor in the production of emulsions is a significant difference in density between oil and water. Essential oils have an average density of about 0.845 g / l, while the density of water is 1.0 g / l. It is therefore necessary to align low-density essential oil by adding substances that increase density. Substances that increase density is rezynogum (estergum or damargum).

Results and discussion

Technology of preparation of emulsions with gum arabic is different from the technology of emulsifying starch. An important factor for emulsions with particles up to 1 micron is the selection pressure homogenizer for some water and oil phases.

The optimal parameters of emulsion technology using gum arabic, given its dissolution features:

- The temperature of the aqueous phase 31 ° C;
- Temperature-fat phase 42 ° C;
- Pre-emulsion-temperature 30-35 ° C, using turbo-mixer high-speed turns, stirred for 10 minutes, get diameter particles 3mk
- The temperature homogenization pre-emulsion 30-35 ° C
- -Pressure homogenizer at 280/50 bar (homogenization spend 2 times) get to 1mk diameter particles.
- The optimal parameters of emulsion technology using starch, especially given its dissolution:
- The temperature of the aqueous phase 42 ° C (dissolution of starch is carried out with stirring at a low rate of speed mixer, 30 pp. injected fat phase and stirrer speed increased to maximum, stir 2 min);
- Fat-temperature phase 20-22 ° C;
- Pre-emulsion temperature 20-22 °C, particles 5 microns in diameter, turbo-mixer high-speed turns are not used, since the formation of foam you want to stand for several days.
- Pressure homogenizer at 230/50 bar (homogenization spend 2 times) get diameter particles at 1mk.

Dissolve gum arabic is faster and easier than with the dissolution of starch as emulsion obtained using gum arabic, stable in quality and more expensive in value compared with emulsions prepared by using starch. For the selection of optimal parameters emulsion in

quality and in value, sometimes replacing 18% of the total gum arabic in an emulsion of 12% starch.

Found that during storage products with particle size more than 1.0 microns appear so-called "creaming" which involves breaking the structure of the emulsion and the conversion of oil into larger particles and floating them to the surface. In contrast, the products manufactured using the emulsion with a particle size of 0.1 microns to 1.0 microns above changes were observed.

Conclusion

Aromatic emulsions are promising for application in the food industry. Getting emulsions - a process that depends on many factors - ingredients composition, technological regimes and specific equipment. The technological scheme of obtaining food emulsions.

The main parameters to be controlled in the manufacturing process:

- temperature conditions for the preparation of emulsifiers and phases;
- the speed and intensity of mixing of the components in the formulation pre-emulsion;
- pressure in Homogenizers, by which regulated particle size;
- number of cycles (duration) homogenization.

Basic control in the finished emulsion:

- the size of particles;
- rheological properties (density, viscosity system);
- optical properties (color, transparency);
- microbiological stability;
- toxicological parameters monitored necessarily because further scope emulsions are food.

Thus, as a result of the studies found that the manufacture of emulsion products, in order to maintain their stability and quality, to consider particle size emulsion, which should not exceed 1.0 microns.

References

1. (2012), *National starch & Chemical UK. Information and promotional materials.*
2. Borisenko O.V., Alekseev J.A., Klimov S. (2002), Methods of creating highly concentrated flavoring emulsions for soft drinks, Food ingredients: raw materials and additives, 2, pp. 18-19.
3. D.E. Pszczola (2001), How Ingredients Help Solve Beverage Problems, Food Technology / Products and Technologies, 55(10).
4. P. Gerlat (2000), *Beverage Stabilizers*, Weeks Publishing Company.
5. (2003) Bogach Aromatic emulsion for manufacture of soft drinks, Food & Drinks, *Food & Beverage*, 4, pp. 10-11.
6. S. J. Byrd (2001), *SAIB - the oldest new ingredient for the beverage market, Food*, Nutrition Laboratory, Kingsport.
7. Merkt (2001), *Weighting agents in cloudy soft drinks*, Nutrinova Inc.
8. (2010), *Informatsionno and promotional materials*, CNI, Fhanse
9. A.M. Helmenstine (2003), *BHA and BHT*, About Inc.
10. Stephen P. and others (2003). *Cholesterol lowering beverage, U.S. Patent for invention № 6576285*, Bader, Fowler.